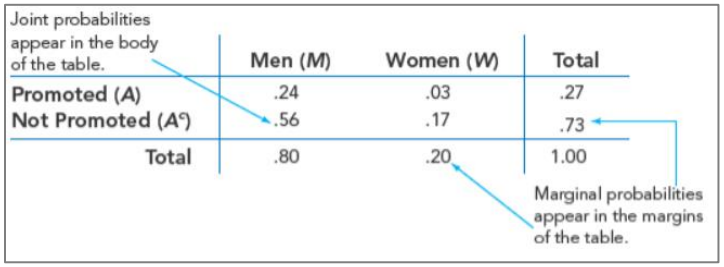
Experiment: a process that generates well-defined outcome. **Sample space:** the set of all experimental outcomes. **Sample point:** an element of the sample space. Exp="Toss a coin", Outcomes=Head, Tail. Exp="Roll a die", Outcomes=1,2,3,4,5,6
Probabilities assigned to each outcome must be between 0 and 1. The sum of the probabilities for all exp. outcomes must equal 1.



Joint prob: the prob. of two events both occurring. ("Promoted" AND "Male")
Marginal prob: the values in the margins of a joint prob. table. (Only looking at 1 event, "Promoted")
"Given that" is conditional. Given=Total. .24/.80=.30
Discrete probability distribution for x = Table with **x | f(x)**

Random variable: numerical description of the outcome of an experiment.
Discrete: finite number of values or infinite sequence of values.

Random Experiment	**Random Variable (x)**	**Possible Values for Random Variable**
Flip a coin	Which face is showing	Heads=1, Tails=0
Roll a die	Number of dots showing on top of die	1, 2, 3, 4, 5, 6

Continuous: any numerical value in an interval or collection of intervals.

Random Experiment	**Random Variable (x)**	**Possible Values for Random Variable**
Customer visits a web page	Time customer spends on page	X > 0
Fill a soft drink can (max 12.1 oz)	Number of ounces	0 < X < 12.1

Probability Distribution: a description of how the probabilities are distributed over the values of the random variable.
Probability Function: a function, denoted by f(x), that provides the probability that x assumes a particular value.

Required Conditions for Discrete Probability Function: $f(x) \geq 0$ AND $\sum f(x) = 1$	**Expected**	**Possible Values for Random Variable**
Customer visits a web page	Time customer spends on page	X > 0
Fill a soft drink can (max 12.1 oz)	Number of ounces	0 < X < 12.1

Binomial Experiment Requirements: 1. Experiment consists of **n** identical trials. **2.** Two outcomes possible (success/fail). **3.** Prob. of success, **p**, does not change from trial to trial. **4**. Trials are independent. **x**=# of success, **p**=prob of success, **n**=# trials, **f(x)**=prob of **x** successes out of **n** trials. Start by building function with **n** and **p**. Example: n=10, p=.10, f(x) = (10 choose x) * .1^x(1 - .1)^10-x
Next build prob table. **x | f(x)**

x	**f(x)**
0	.3487
1	.3874

Binominal Distribution Expected Value: **E(x) = n * p** Variance: **var(x) = n * p(1 – p)**

Counting Rule for Combinations

$$C_n^N = \binom{N}{n} = \frac{N!}{n!\,(N-n)!}$$

Counting Rule for Permutations

$$P_n^N = n!\binom{N}{n} = \frac{N!}{(N-n)!}$$

Required Conditions for Discrete Probability Function:

$f(x) \geq 0$ **AND** $\sum f(x) = 1$

Expected Value of a Discrete Random Variable

E(x) = M = $\sum x * f(x)$

Variance of a Discrete Random Variable

$var(x) = \sigma^2 = \sum (x - E(x))^2 * f(x)$

Binomial Probability Function

$$f(x) = \binom{n}{x} p^x (1-p)^{(n-x)}$$

Uniform Probability Density Function
Area (Prob.) = length * width

$$f(x) = \begin{cases} \frac{1}{b-a} & \text{for } a \leq x \leq b \\ 0 & \text{elsewhere} \end{cases}$$

Expected Value & Variance Uniform Continuous Probability Distribution

$E(x) = (a + b) / 2$
$var(x) = (b - a)^2 / 12$

Discrete Random Variable: Compute the Expected Value and Variance of x

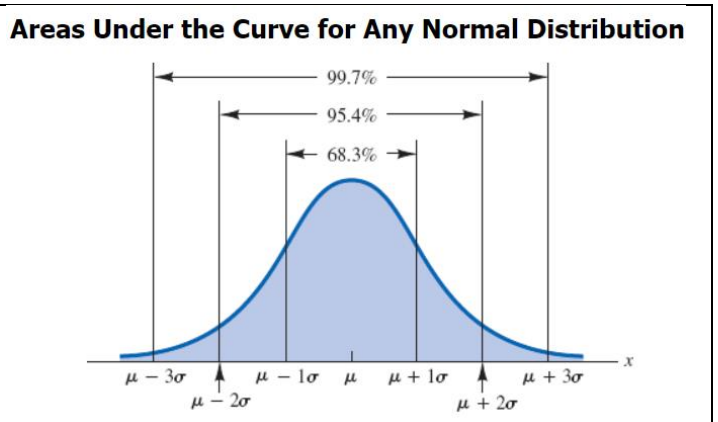
x	f(x)	x * f(x)	x – E(x) [M]	$(x - M)^2$	$(x - M)^2 * f(x)$
10	.25	2.5	-7.5	56.25	56.25*.25=14.0625
20	.75	15	2.5	6.25	6.25*15=93.75
TOTALS	1	17.5 = E(x)			Var(x)=107.8125

Probability Density Function (PDF): a function used to compute probabilities for a continuous random variable. The area under the graph of a PDF represents the probability.
Uniform Probability Distribution: a continuous probability distribution for the probability that a random variable will assume a value in any interval is the same for each interval.

Standard Normal Probability Distribution:
Three types of calculations:

1. Prob that Z is less than or equal to a given value.
   P(Z < z)
2. Prob that Z is between two given values.
   P(z < Z < z)
3. Prob that Z is greater than or equal to a given value.
   P(Z > z) OR **1 - P(Z < z)**

Draw the graph to visualize the calculation needed.



Converting to Standard Normal Random Variable:

1. **Z = (x – Mean) / Std Dev**
2. **Lookup z score in Prob table.**
3. **Resulting value is the probability.**

Given that z is a standard normal variable, find z:

1. Find area to the left.
2. Reverse lookup area value in Prob table to find z.

The area to the left of z is .9750, z=1.96
The area to the right of z is .1314 = 1-.1314 = .8686, z=1.12